

the sensor people

## **S400**

### Safety Hinge Switches



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## 1 About this document

### 1.1 Other applicable documents

The information on the S400 Safety Hinge Switch is divided into two documents. Document "Application information" contains only the most important safety notices.

- ↳ For the safe implementation, testing and operation, download document "Safe implementation and operation of the S400" from <http://www.leuze.com/s400> or request it from [service.schuetzen@leuze.de](mailto:service.schuetzen@leuze.de) or tel. +49 8141 5350-111.

Table 1.1: Documents on the Safety Hinge Switch

Purpose and target group	Title	Source
Detailed information for all users	Safe implementation and operation (this document)	On the Internet, download from: <a href="http://www.leuze.com/s400">http://www.leuze.com/s400</a>
Basic information for technicians and machine operators	Application information	Print document part no. 607240 included in the delivery contents of the product

## 1.2 Used symbols and signal words

Table 1.2: Warning symbols and signal words

	Symbol for dangers
NOTICE	Signal word for property damage Indicates dangers that may result in property damage if the measures for danger avoidance are not followed.
CAUTION	Signal word for minor injury Indicates dangers that may result in minor injury if the measures for danger avoidance are not followed.
WARNING	Signal word for severe injury Indicates dangers that may result in severe or fatal injury if the measures for danger avoidance are not followed.
DANGER	Signal word for life-threatening danger Indicates dangers that will result in severe or fatal injury if the measures for danger avoidance are not followed.

Table 1.3: Other symbols

	Symbol for tips Text passages with this symbol provide you with further information.
	Symbols for action steps Text passages with this symbol instruct you to perform actions.

## 2 Safety

Before using the Safety Hinge Switch, a risk evaluation must be performed according to valid standards (e.g. EN ISO 12100-1, EN ISO 13849-1, EN ISO 14121). For mounting, operating and testing, document "Safe implementation and operation of the S400" as well as all applicable national and international standards, regulations, rules and directives must be observed (e.g. machinery directive, low-voltage directive, work-equipment directive, safety regulations, accident-prevention regulations, EN 1088, EN ISO 13849-1, EN 60204-1, EN 954-1). Observe and print out relevant and supplied documents and distribute to the affected personnel.

- ☞ Before beginning work with the Safety Hinge Switch, completely read and understand the documents applicable to the respective task.

The following standards apply for the risk evaluation at the protective device prior to using the Safety Hinge Switch:

- EN ISO 14121, Safety of machinery, risk evaluation
- EN ISO 12100-1, Safety of machinery
- EN ISO 13849-1, Safety-related parts of control systems

The realizable category of the integration in control circuits according to EN ISO 13849-1 and EN 954-1 is dependent on the used contact block and wiring.

In particular, the following national and international legal regulations apply for the start-up, technical inspections and work with Safety Hinge Switch:

- Machinery directive 2006/42/EC
- Low voltage directive 2006/95/EC
- Use of work equipment directive 89/655 EEC
- Safety regulations
- Accident-prevention regulations and safety rules

### 2.1 Proper use

To ensure proper personnel protection, the Safety Hinge Switch must be mounted, connected and started-up by trained personnel. It must be in perfect condition and inspected regularly. For the switching process, this Safety Hinge Switch must be connected to the moveable guard in a non-detachable, tamper-proof manner. This connection must also be form-fitting with positive actuation.

The rules and regulations for protection and safety at work and the recognised safety-related rules and regulations must be observed. These include:

- EN 1088, Interlocking devices associated with guards
- EN ISO 13849-1, Safety-related parts of control systems
- EN 60204-1, Electrical equipment of machines

S400 Safety Hinge Switches must be connected in such a way that a dangerous state can only be activated while the protective device is closed and so that the dangerous state stops upon opening of the protective device. It must not be used if the point of operation can be accessed during the lag time before the dangerous state has ended.

Connection conditions:

- the dangerous state can only be activated while the protective device is closed
- opening the protective device while the machine is running triggers a STOP command and ends the dangerous state

Furthermore, the S400 Safety Hinge Switch must **not** be used under the following conditions:

- rapidly changing ambient temperature (leads to condensation)
- in the event of strong physical shocks
- in explosive or easily flammable atmospheres
- the mounting locations are not sufficiently stable
- the safety of multiple persons is dependent on the function of this Safety Switch (e.g. nuclear power plants, trains, aircraft, motor vehicles, incinera-tors, medical devices)



For machines with longer slowdowns, a Safety Locking Device must be used.

Handling the Safety Hinge Switch:

- ↳ Observe the permissible environmental conditions for storage and operation (see chapter 14 "Technical data").
- ↳ Immediately replace damaged Safety Hinge Switch according to these instruc-tions.
- ↳ Use cable gland, insulation materials and connecting wires of the appropriate protection rating.
- ↳ Protect the Safety Hinge Switch from penetrating foreign bodies (e.g. shavings, sand and blasting agent).
- ↳ Cover before performing painting work.
- ↳ Immediately clean any contamination from the Safety Hinge Switch that impacts function according to these instructions.
- ↳ Do not open the cover on the rear side.
- ↳ Make no structural changes to the Safety Hinge Switch.

## 2.2 Competent personnel

Prerequisites for competent personnel:

- suitable technical training
- knows the rules and regulations for occupational safety, safety at work and safety technology and can assess the safety of the machine
- knows the instructions for the Safety Hinge Switch and the machine
- was instructed by the responsible individuals on the mounting and operation of the machine and of the Safety Hinge Switch

## 2.3 Responsibility for safety

Manufacturer and operator of the machine must ensure that the machine and implemented Safety Hinge Switch function properly and that all affected persons are adequately informed and trained.

The type and content of all imparted information must not lead to unsafe actions by users.

The manufacturer of the machine is responsible for:

- safe machine construction
- safe implementation of the Safety Hinge Switch
- imparting all relevant information to the operator
- adhering to all regulations and directives for the safe starting-up of the machine

The operator of the machine is responsible for:

- instructing the operating personnel
- maintaining the safe operation of the machine
- adhering to all regulations and directives for occupational safety and safety at work
- regular testing by competent personnel

## 2.4 Exemption of liability

Leuze electronic GmbH + Co. KG is not liable in the following cases:

- Safety Hinge Switch is not used as intended
- safety notices are not adhered to
- mounting and electrical connection are not properly performed
- proper function is not tested (see chapter 9 "Testing")
- incorrectly set switching angle
- changes to the Safety Hinge Switch

### 3 Device description

The Safety Hinge Switch of the S400 series is a very compact and stable electro-mechanical switching device in a housing made of metal; the device satisfies protection rating IP 67. The actuator is integrated in the housing and, depending on the version, the electrical connection is established via a cable or an M12 plug. The opening angle of the Safety Hinge Switch extends up to 180°. The switching angle is adjustable and can be adjusted multiple times if necessary (e.g. misadjusted door).



- 1 Safety Hinge Switch
- 2 Cable entry, M12 plug
- 3 Opening for adjusting the switching angle

Table 3.1: S400 Safety Hinge Switch

Article	Part No.	Description
S400-M4CB2-B	63000 400	2m cable, cable entry at bottom (with left installation)
S400-M4M12-B	63000 401	M12 plug, 8-pin, bottom (with left installation)

Table 3.2: Dimensions in mm

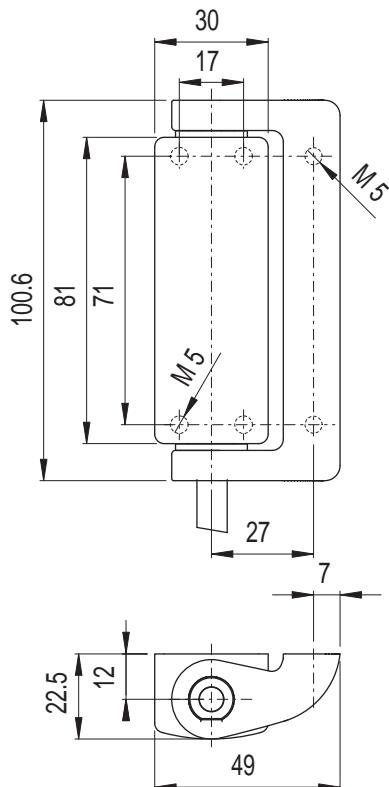


Figure 3.1: S400-M4CB2-B

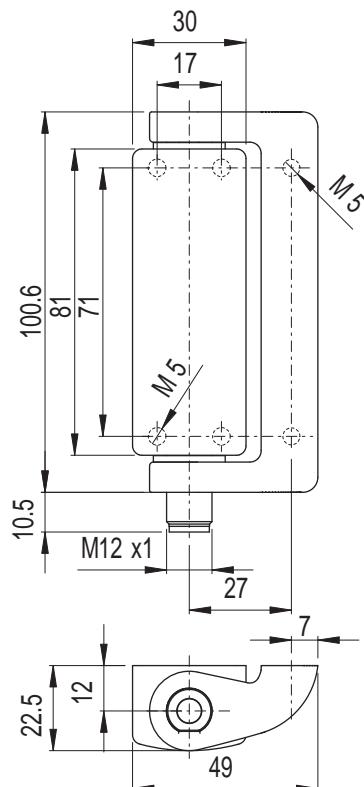


Figure 3.2: S400-M4M12-B

## **4 Functions**

S400 Safety Hinge Switches are used as a mechanical hinge and for position monitoring of turning, bearing-mounted guards. The safety contacts are force-opened as soon as the preset switching angle is reached. As a result, the machine can only be switched on if the protective device is closed.

## **5 Applications**

The Safety Hinge Switch is suitable for e.g. the following protective devices:

- turning or swivelling moveable guards, flaps and hoods
- in environments with high dust concentration or high levels of particulate matter

## 6 Mounting



### WARNING

**Serious accidents may result if the Safety Hinge Switch is not mounted properly!**

The protective function of the Safety Hinge Switch is only ensured if correctly mounted and adjusted for the respective, intended area of application.

- ↳ Mounting may only be performed by competent personnel.
- ↳ Observe standards, regulations and these instructions.
- ↳ Protect the housing from materials penetrating the enclosure (environmental conditions see chapter 14 "Technical data").
- ↳ Use separate mechanical limit stop (see figure 6.2).
- ↳ Set the switching angle so that the guard cannot be circumvented (e.g. by reaching around or walking behind).
- ↳ Test to ensure proper function.

### 6.1 Mounting the Safety Hinge Switch

Prerequisites for mounting:

- M5 fastening screws of the correct length (see figure 6.1)

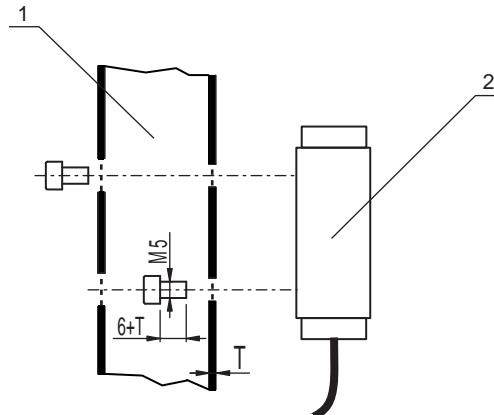


Figure 6.1: Hinge mounts; length of the fastening screws =  $6 + T$  mm

- 1 Frame (e.g. hollow chamber aluminium profile)
- 2 Safety Hinge Switch

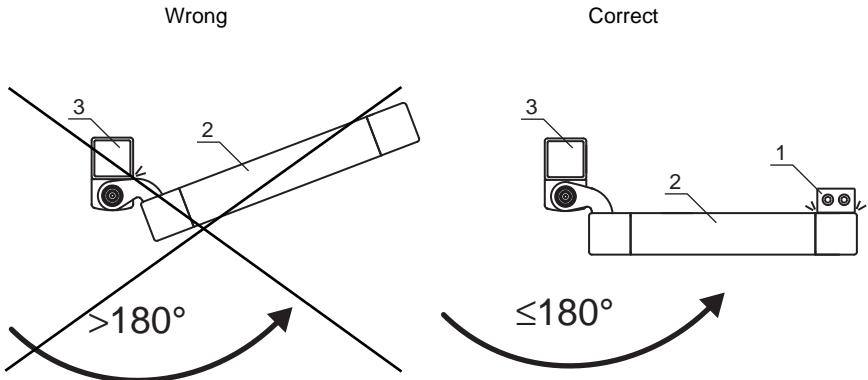


Figure 6.2: Mechanical limit stop (1) for the moving part of the protective device

- 1 Mechanical limit stop
- 2 Door
- 3 Profile

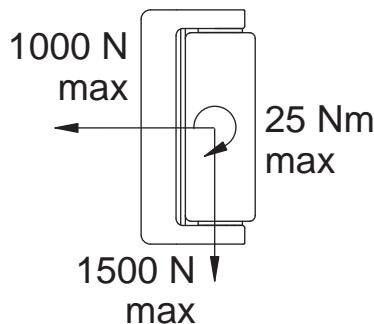


Figure 6.3: Maximum load of the Safety Hinge Switch

- ↳ Select the mounting locations for Safety Hinge Switches and additional hinges (if necessary) so that the following conditions are satisfied:
  - accessible to qualified personnel for testing and replacement
  - form-fitting mounting is possible

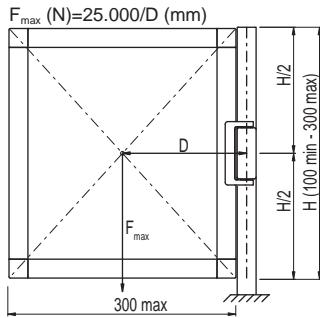


Figure 6.4: Door with 1 Safety Hinge Switch

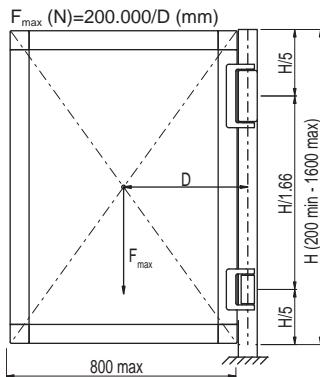


Figure 6.5: Door with 1 Safety Hinge Switch and 1 additional hinge

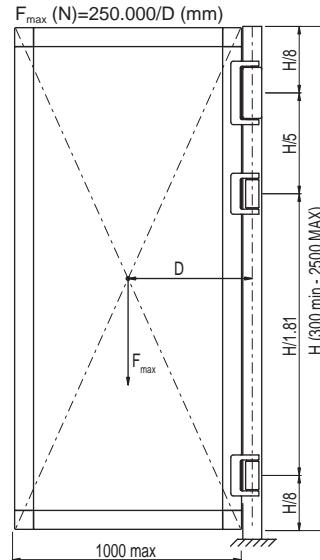


Figure 6.6: Door with 1 Safety Hinge Switch and 2 additional hinges

$F_{max}$  = Force exerted by door weight in N

D = Distance from the centre of gravity of the door to the hinge axis in mm

**NOTICE**

**The Safety Hinge Switch may be damaged if mounted improperly!**

Screws that are too long or too short as well as faulty bore holes may damage the hinge.

- ❖ Measure the length of the M5 screws exactly (see figure 6.1).
- ❖ The position of the mounting bore holes should be exactly parallel to the profile axis.

- ❖ Prepare the bore holes for the Safety Hinge Switch at the indicated positions (M5).

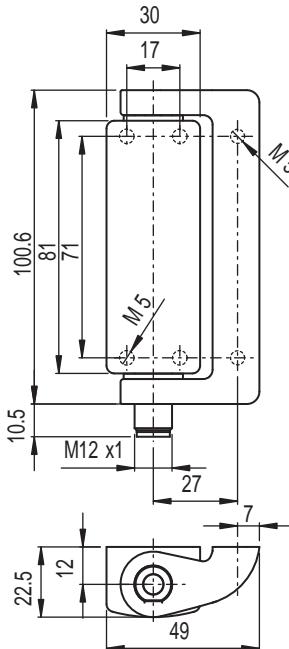
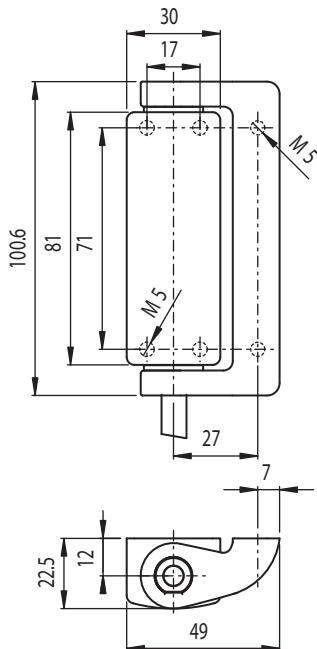


Figure 6.7: Bore holes S400-M4CB2-B Figure 6.8: Bore holes S400-M4M12-B

☞ If necessary, prepare bore holes for additional hinges at the indicated positions (M5).

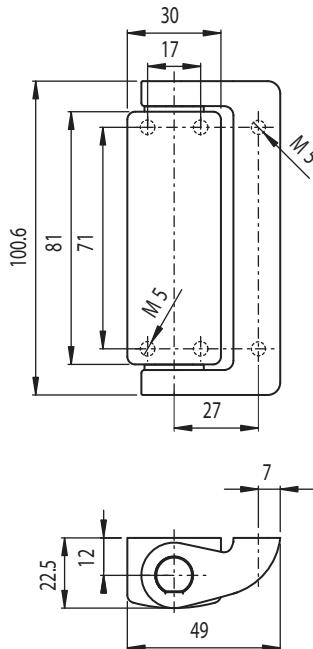


Figure 6.9: Bore holes for additional hinge

☞ Screw down Safety Hinge Switch and additional hinges with 2–3Nm.

- ☛ Set the switching angle of the Safety Hinge Switch with a Phillips screwdriver (model PH1) (adjustment range: maximum 1 turn).



- ☛ Test whether the guard can be circumvented; if necessary, readjust the switching angle (acc. to EN ISO 13857).



**WARNING**

**Failure of the switching function in the event of moisture, dust and tampering!**

↳ Always plug the opening for adjusting the switching angle.

↳ Plug the opening for adjusting the switching angle with the sealing plug.



## 7 Electrical connection



### WARNING

**Serious accidents may result if the electrical connection is faulty!**

⚡ Electrical connection may only be performed by competent personnel.

### 7.1 Connecting the contact block

Prerequisites:

- temperature stability of the cable insulation material must be greater than the maximum temperature of the housing (see chapter 14 "Technical data")
- maximum current load is observed (see chapter 14 "Technical data")

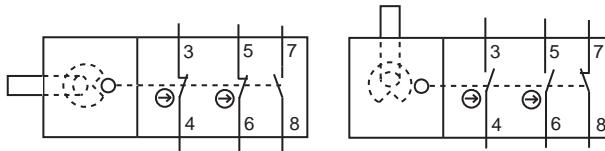


Figure 7.1: Contact block 2 NC + 1 NO (S400-M4CB2-B, S400-M4M12-B)



### DANGER

**Risk of death by electric shock!**

⚡ Interrupt the voltage supply to the Safety Hinge Switch.

⚡ Connect the contact block according to the circuit diagram.

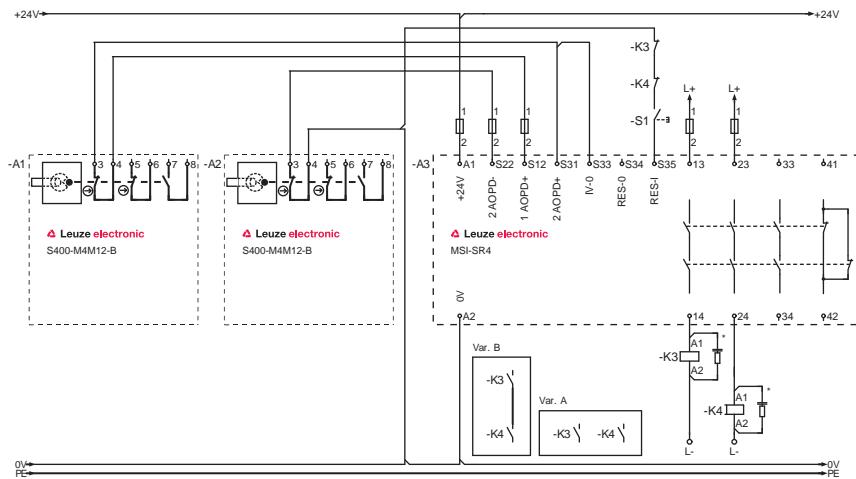
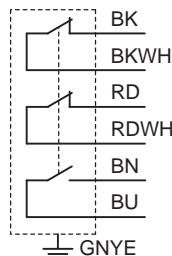


Figure 7.2: Connection example S400-M4M12-B



BK = Black  
 WH = White  
 RD = Red  
 BN = Brown  
 BU = Blue  
 GN = Green  
 YE = Yellow

Figure 7.3: S400-M4CB2-B Assignments of the connecting cable

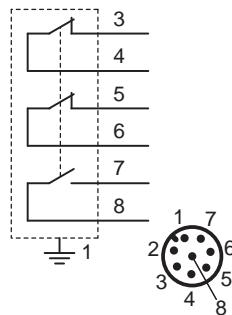


Figure 7.4: S400-M4M12-B Assignments of the 8-pin M12 plug

## **8 Setting the device into service**

Prerequisites:

- Safety Hinge Switch is mounted, adjusted, plugged and connected according to these instructions
- operating personnel have been trained in the correct use

↳ Test the function of the Safety Hinge Switch (see chapter 9 "Testing").

The Safety Hinge Switch is then ready for use.

## **9 Testing**

S400 Safety Hinge Switches are maintenance-free. Nevertheless, they must be replaced after maximum 1,000,000 switching cycles.

↳ For the testing intervals, observe nationally applicable regulations.

↳ Document all tests in a comprehensible manner.

### **9.1 To be performed prior to the initial start-up by competent personnel**

↳ Check whether the Safety Hinge Switch is operated according to its specified environmental conditions (see chapter 14 "Technical data").

↳ Test to ensure proper mechanical and electrical function (see chapter 9.2).

### **9.2 To be performed periodically by competent personnel**

#### **Mechanical function**

↳ Stop the dangerous state.

↳ Check that the components are securely fastened.

↳ Test the cable entry for leaks and check that the opening for setting the switching angle is plugged.

↳ Check Safety Hinge Switch and actuator for damage, deposits, deformation and wear.

↳ Open and close the protective device several times, testing the ease of movement while doing so.

### Electrical function



#### **WARNING**

**Severe injuries may result if tests are not performed properly!**

⌚ Make certain that there are no persons in the danger zone.

- ⌚ Stop the dangerous state and open the protective device.
- ⌚ Make certain that the machine cannot be started while the protective door is open.
- ⌚ Close the protective door and start the machine.
- ⌚ Test several times whether the machine stops upon opening of the protective door.
- ⌚ Make certain that the guard cannot be circumvented and that the switching angle is set to a sufficiently small value (EN ISO 13857).
- ⌚ Test whether the dangerous state ends before the point of operation can be reached.

### 9.3 To be performed daily by the operating personnel



#### **WARNING**

**Severe injuries may result if tests are not performed properly!**

⌚ Make certain that there are no persons in the danger zone.

- ⌚ Stop the dangerous state and open the protective device.
- ⌚ Check the Safety Hinge Switch and cable entry for damage or tampering.
- ⌚ Test the cable entry for leaks and check that the opening for setting the switching angle is plugged with the original plug.
- ⌚ Make certain that the machine cannot be started while the protective device is open.
- ⌚ Close the protective device and start the machine.
- ⌚ Test whether the machine stops upon opening of the protective device.

## **10 Cleaning**

There must be no soiling (e.g. moisture and dust), especially at the joints of the Safety Hinge Switch and the area near the sealing plug (switching angle adjustment).

Prerequisites for regular cleaning:

- machine is switched off
- voltage supply to the Safety Switch is interrupted

↳ Clean the Safety Hinge Switch (e.g. with a vacuum cleaner).

## **11 Disposing**

↳ The nationally valid regulations for electro-mechanical components are to be observed when disposing.

## **12 Service and support**

Contact data:

Leuze electronic GmbH + Co. KG

Liebigstraße 4

D-82256 Fürstenfeldbruck

Phone: +49 8141 5350-111

## **13 Accessories**

Table 13.1: Additional hinge for the S400 Safety Hinge Switch

Article	Part No.	Description
AC-H-S400	63000 770	Additional hinge

## 14 Technical data

Table 14.1: General

Switch type	Interlock device without guard interlocking in accordance with EN 1088
Internal actuator	Safety Switch in hinge, encapsulated
Max. load	axial: 1500Nm radial: 1000Nm torsional: 25Nm
Actuation speed	min. 2°/s, max. 90°/s
Actuation angle	max. 180°
Actuating path with forced separation	min. +4° (from switching point)
Mechanical life time in accordance with IEC 60947-5-1	10 <sup>6</sup> switching cycles
Actuation frequency according to IEC 60947-5-1	max. 720 per hour
Life time according to EN ISO 13849-1	on request
Number of cycles before dangerous failure (B10d) according to EN 61810-2 with DC1 (ohmic load) with AC1 (ohmic load) with DC13 (inductive load) with AC15 (inductive load) low load (20% rated load)	on request
Usage category according to EN 60947-5-1	AC 15 / DC 13: Ue 24 V, Ie 2 A
Dimensions (dimensional drawings)	see chapter 3 "Device description"

Table 14.2: Safety

Protection rating	IP 67
Contact allocation	2 NC + 1 NO
Contact material	silver alloy, solid
Switching principle	slow-action contact
Opening of contact	positive-forced
Rated insulation voltage	30VAC, 36VDC
Conventional thermal current	max. 2A
Short-circuit protection according to IEC 60269-1	2A, 500V, type gG

Table 14.3: Housing

Housing material	metal
------------------	-------

Table 14.4: Connection

Number of cable entries	1
Type of cable entry	S400-M4CB2-B: cable S400-M4M12-B: M12 plug
Conductor cross-section (stranded)	7 x 0.5 mm <sup>2</sup> (S400-M4CB2-B)
Cable routing side	floor-side with left installation

Table 14.5: Environment

Temperature range, operation	-25 ... +80°C (S400-M4CB2-B) -40 ... +80°C (S400-M4M12-B)
Dirt levels, external, in accordance with EN 60947-1	3

## 15 EC Declaration of Conformity

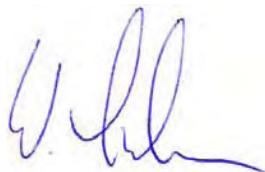
Leuze electronic GmbH + Co. KG  
Liebigstraße 4  
D-82256 Fürstenfeldbruck

We hereby declare that the S400 Safety Hinge Switch (see name plate for part no.) in the form in which it is marketed by us conforms with the relevant safety and health requirements of the listed EC directives <sup>1</sup> (including all changes) and that the listed standards <sup>1</sup> were used in its design and construction.

Fürstenfeldbruck, 15 September 2008



ppa. Dr. Holger Lehmitz  
Director of the Safety Systems Division



ppa. Werner Lehner  
Director of Product Management  
Safety Systems Division